STANDARD OPERATING PROCEDURE

Instructions for Calibration and Use of the WL16U Water Depth Data Logger

KEY WORDS

Water depth, data logger, calibration

APPROVALS

APPROVED BY: Original signed by: DATE: 12/19/07
Kean S. Goh, Ph.D.
Environmental Monitoring Branch Management

APPROVED BY: _____ DATE: 12/19/07
Sheryl Gill
Environmental Monitoring Branch Staff Scientist

APPROVED BY: _____ DATE: 12/19/07
Carissa Ganapathy
Environmental Monitoring Branch Quality Assurance Officer

PREPARED BY: _____ DATE: 12/19/07
Rick Bergin
Environmental Monitoring Branch Scientist

Environmental Monitoring Branch organization and personnel, such as management, senior scientist, quality assurance officer, project leader, etc., are defined and discussed in SOP ADMN002.01.

1.0 INTRODUCTION

1.1 Purpose

This document provides instructions for the Global Water WL16U Data Logger. The WL16U Data Logger measures water depth and can be used to calculate water volumes for surface water when the cross sectional area and reference flow is known. Reference flow may be determined by a properly engineered flume or by gauging to create a depth to flow relationship. The data logger can measure water level in ground water wells. This SOP will aid in installing, launching, calibrating, and data retrieval of the WL16U Data Logger.

1.2 Definitions

1.2.1 Baud rate- data transmission speed between the logger and the computer.

1.2.2 Low/High EU- the lowest and highest engineering units used in the calibration process.

1.2.3 Low/High Raw- raw data values as measured by the data logger that correspond to the low/high EU used during calibration.

1.2.4 Reference level- reference point where all measurements are compared. Ex. When measuring water depth, the reference level is at the water surface and is set at a depth of zero measurement units.

2.0 MATERIALS

2.1 WL16U Data Logger

2.2 Global Logger Software

2.3 Manual

2.4 USB Cable

2.5 Computer

3.0 PROCEDURES

3.1 Install Software

3.1.1 Insert WL16U Data Logger software CD into your CDROM drive.

3.1.2 Follow the Hardware Wizard instructions. Do not allow Hardware Wizard to automatically find the drivers; you must specify the location (CDROM) manually.

3.1.3 Allow the Hardware Wizard to make two passes before download is complete

3.2 Launching

3.2.1 Connect WL16U Data Logger to the computer via the USB cable.

3.2.2 The connect box should automatically appear. Click the **Direct** radio button. Select the USB serial port that the driver was assigned to; it should be labeled “Global Logger USB Device”. Set the baud rate to the highest setting; this will facilitate the fastest operation. Click **Connect** to make the connection.

3.2.3 Click the **Setup** button. Change settings to desired configuration.

3.2.4 Set the desired sensor warm-up time, which adjusts the time the logger applies power to the sensor before taking a reading; shorter times conserve the battery life.

3.2.5 Leave baud rate set to *Auto Baud Rate* unless you plan to use this logger in a telemetry application. In that case, the baud rate must be set to the same number as in 3.2.2.

3.2.6 Make sure “Wrap records at end of storage” is unchecked. This will prevent the overwriting of records and will stop the logger when its memory is full. The logger can hold 81,759 recordings.

3.2.7 Logarithmic Timing speeds up the sampling rate over time and is typically used in groundwater pump studies.

3.2.8 Checking the “Log only if Channel 1 change exceeds +/-“ option causes the logger to record the current reading in memory only if it exceeds the previous reading by the preset raw amount entered in the numeric field.

3.2.9 To find the actual number of raw data units per engineering unit, use the calibration numbers in the Analog Setup screen for channel 1 as follows: Raw Data Units per Engineering Unit = (High Raw – Low Raw) / (High EU – Low EU).

3.2.9.1 Example: Assume a 15-foot water level sensor has a High EU of 15, a Low EU of zero, a High Raw of 62256 (logger reading corresponding to 15-foot) and a Low Raw of 13104 (logger reading corresponding to 0-foot). (62256-13104) / (15-0) = 3277 units/foot. Thus, if you want to log only when a reading exceeds the previous one by 0.5 feet, set the deviation to about 1638 (half of the units/foot). Click the numeric field to enter the desired range.

3.2.10 Check the Alarm start and stop times if desired. The start and stop cycle is a one time occurrence. Once stopped, the logger will not log until it is reprogrammed.

3.2.11 Click **Program Settings** to program all settings into the data logger.

3.2.12 Click **Back to Main Window** to return to the main screen. Click **Clear History** to erase stored memory buffer. Click **Disconnect** and remove USB cable from data logger. It is now ready to be deployed into the field.

3.3 Calibration

3.3.1 Launch data logger and enter the Setup Menu as stated in 3.2.

3.3.2 Click on the upper left tab titled “Analog Channels”.

3.3.3 Set the channel you wish to calibrate to the appropriate unit of measurement, i.e. feet, inches, meters, etc.

3.3.4 Click the **Calibrate** button under the desired channel that you wish to calibrate.

3.3.5 Enter the High EU value that will be used to calibrate the logger. The High EU is any depth that is available for calibration; even if the sensor can measure above it. Click **Next**.

3.3.6 Place the data logger sensor in the depth that matches the High EU. Wait for the data reading to stabilize. Click **Next**.

3.3.6.1 Example: If the units/channel in 3.3.3 are set to feet and the High EU value in 3.3.5 is set to 8, then you must lower the sensor to a depth of 8 feet. It does not matter what units or High EU you choose, just as long as you can lower the sensor to that depth.

3.3.7 Enter the chosen Low EU value, which may not be the lowest reading the sensor can output. Set it to zero if you wish to measure from the end of the sensor to the water's surface. Click **Next**.

3.3.8 Place the sensor in the condition that matches the Low EU. Wait for the data reading to stabilize. Click **Next**.

3.3.8.1 If the Low EU is set to zero, then just remove the sensor from the water. This mimics a water depth of zero.

3.3.9 Click **Program Settings** to program all settings into the data logger. The data logger is now calibrated.

3.3.9.1 The data logger should be calibrated before each deployment. It can often be calibrated in the lab but sometimes must be calibrated in the field due to site-specific constraints; see 5.0 for more details.

3.3.9.2 However, if you wish to return the data logger to its original calibration there are factory pre-set numbers etched on the side of the data logger. Enter these values (High/Low EU and High/Low Raw) to return the data logger to its original calibration if you want

the logger to measure from the end of the sensor to the water's surface.

3.4 Data Retrieval

3.4.1 Launch WL16U Data Logger as discussed in 3.2.

3.4.2 Click on **Get History**.

3.4.3 Click on **Save to File**. Specify the path and file name and click **Save**.

4.0 REMEDIAL ACTION IN CASE OF MALFUNCTION

Call Global Water tech support: 800-876-1172 or 916-638-3270. When calling tech support, please have the following information: model number, serial number, purchase order number, and sales/invoice number.

5.0 STUDY-SPECIFIC DECISIONS

5.1 Adjusting the Zero Reference Level

5.1.1 By changing the Low/High EU numbers in the "Analog Setup" menu the reference level can be changed from the water surface to another chosen level. This doesn't change the calibration; it only changes the scale of the data to read in any desired range. ***Remember: The difference between the High and Low EU numbers must be equal to the depth at which the sensor was calibrated.***

5.1.2 For instance, if you have a sensor with a range of 0-30 feet, the logger has been factory calibrated at a range of 30 feet. The High and Low EU numbers can be changed to read any range without changing the accuracy, as long as the difference between them remains 30 feet. If you need to recalibrate but do not have a 30 foot depth of water available, you can recalibrate at 20 feet (or whatever is available to you) as long as the difference between the High and Low EU numbers is equal to the calibration depth (in this case, 20 feet). If you wish to record the depth from sensor to water surface, the Low EU number is always zero and the High EU number is always equal to the depth at which the sensor was calibrated.

5.1.3 **To record the distance from the top of the well pipe to water level:** Changing the zero reference to the top of the well pipe requires that you know the distance from the top of the pipe to the end of the sensor at the time of installation. ***Note that the cable length provided with the WL16 is not exact and should not be used as a standard without first measuring it***.

5.1.3.1 Place the WL16 in the well at the desired depth.

5.1.3.2 Place a mark on the cable at the point where it meets the top of the well pipe (or other desired reference level).

5.1.3.3 Remove the logger and measure the distance from the tip of the sensor to the mark made in the previous step.

5.1.3.4 Enter this length in the Low EU field in the Setup menu.

5.1.3.5 Using the depth used to calibrate the sensor and the Low EU number from the previous step, subtract the larger number from the smaller one.

5.1.3.6 Enter this new number in the High EU field.

5.1.3.7 Click **Program Settings** to program all settings into the data logger.

5.1.3.8 Re-install the logger the same as before as in 5.1.3.1.

5.1.3.9 Example: Assume that a sensor with a 30-foot maximum range is installed at a depth of 40 feet from the top of the well pipe and that the Low and High Raw data numbers were set at a 25-foot depth. The sensor is installed, a mark is made on the cable where it meets the top of the well pipe, and then removed. The cable is measured at 40 feet from the mark to the tip of the sensor and 40 is entered in the Low EU field. Since the High Raw data number was

set at the calibration depth of 25 feet, 25 is subtracted from 40 and the result of 15 is entered in the High EU field.

5.1.4 **Recording relative water changes, Example 1**: Assume that you wish to set the zero reference point to the lowest water level in the data record. This will show this low level as zero and all others as a positive level above it.

5.1.4.1 Download the historical data and find the lowest water level in the record.

5.1.4.2 Enter the setup menu and note the difference between the Low and High EU numbers; this is always the depth at which the sensor was calibrated.

5.1.4.3 Type the lowest water level from the data record into the Low EU field.

5.1.4.4 Add this number to the calibration depth and enter it into the High EU field.

5.1.4.5 Click **Program Settings** to program all settings into the data logger.

5.1.5 **Recording relative water changes, Example 2:** Suppose you want to set the zero reference level to that of a specific event (date/time or a specific event such as a significant rainfall or a well pump turning on). Note that this will set a zero reference. Other levels are relative to this and can include negative numbers.

5.1.5.1 Download the historical data and find the water level in the record for the reference date/time (or special event) you are interested in.

5.1.5.2 Enter the setup menu and note the difference between the Low and High EU numbers; this is always the depth at which the sensor was calibrated.

5.1.5.3 Type the water level from the data record that corresponds to the specific date/time or event into the Low EU field.

5.1.5.4 Add this number to the calibration depth and enter it into the High EU field.

5.1.5.5 Click **Program Settings** to program all settings into the data logger.

5.1.6 **Recording relative water changes, Example 3:** If you want the current level to read zero you must only take a single reading and offset the Low and High EU numbers by that amount. Note that this will set a zero reference and that other levels are relative to this and can include negative numbers.

5.1.6.1 Install the data logger and take a reading.

5.1.6.2 Enter this reading into the Low EU field as a negative number. If you measure 8.35 feet, enter –8.35 as the new Low EU.

5.1.6.3 Add the calibration depth to this number and enter it in the High EU field.

5.1.6.4 Click **Program Settings** to program all settings into the data logger.

6.0 REFERENCES

1. Global Water Instrumentation, Inc. 2006. WL16 Data Logger Instruction Manual.

2. Manufacturer:

Global Water Instrumentation Inc.
11390 Amalgam Way
Gold River, CA 95670
Tel: 800-876-1172
Fax: 916-638-3270
globalw@globalw.com